FIG. 1

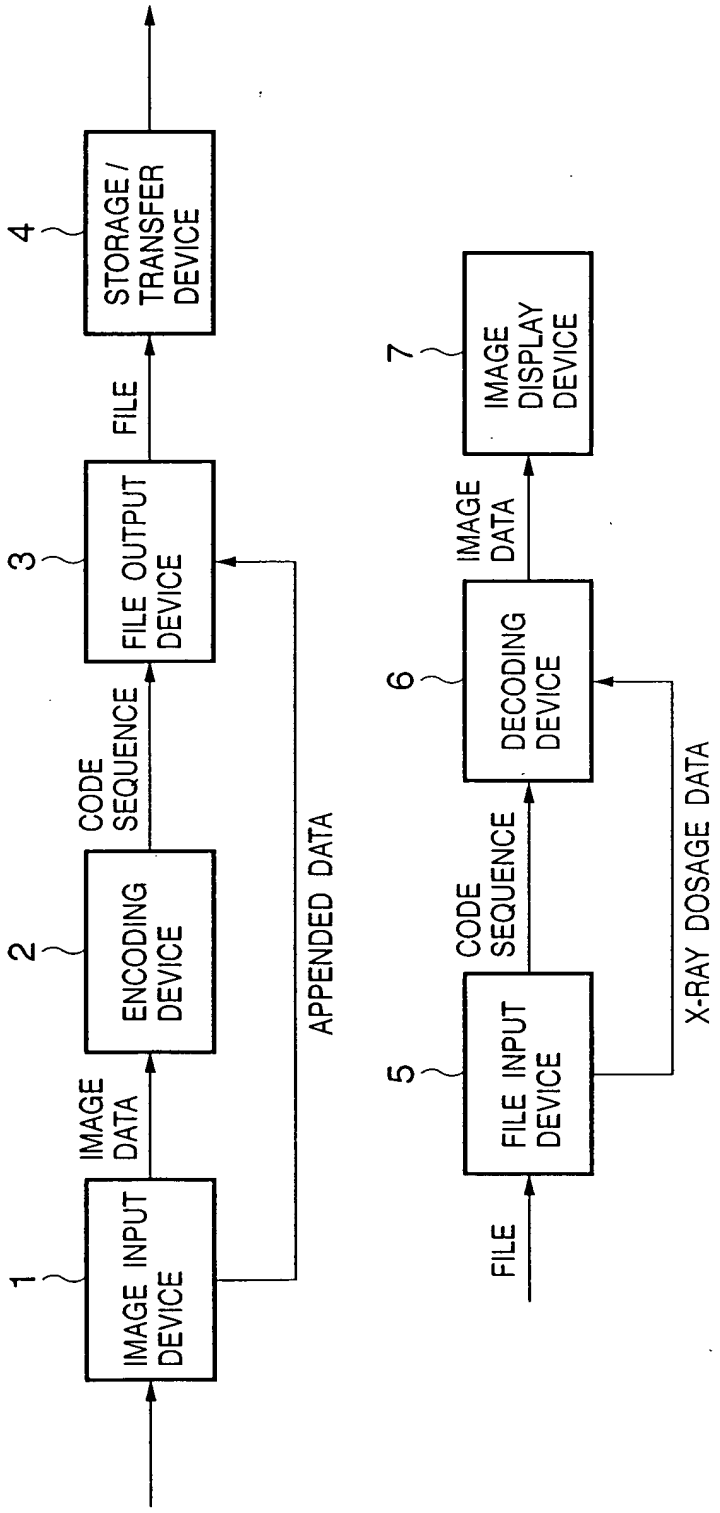
1
IMAGE INPUT DEVICE
IMAGE DATA
2
ENCODING DEVICE
CODE SEQUENCE
3
FILE OUTPUT DEVICE
FILE
4
STORAGE / TRANSFER DEVICE
APPENDED DATA
5
FILE INPUT DEVICE
CODE SEQUENCE
6
DECODING DEVICE
IMAGE DATA
7
IMAGE DISPLAY DEVICE
FILE
X-RAY DOSAGE DATA

FIG. 2

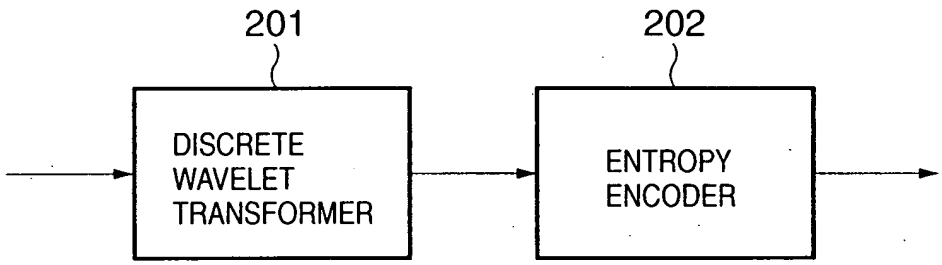

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FIG. 3A

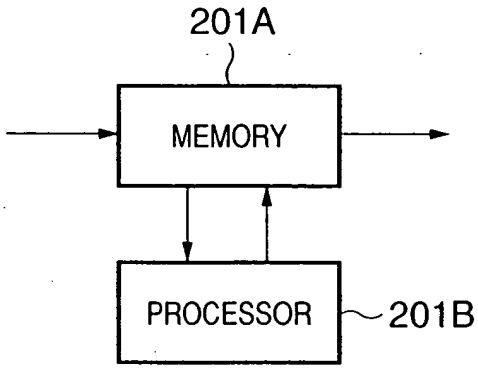

FIG. 3B

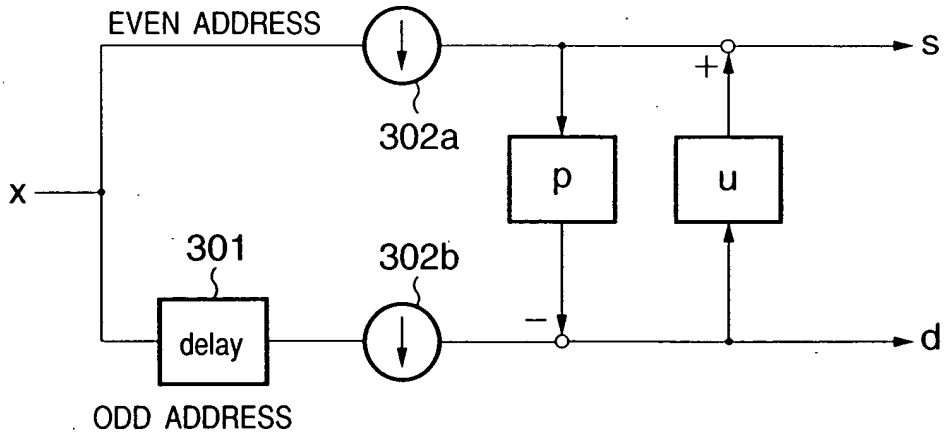

FIG. 3C

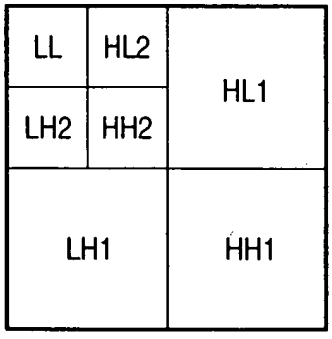

FIG. 4

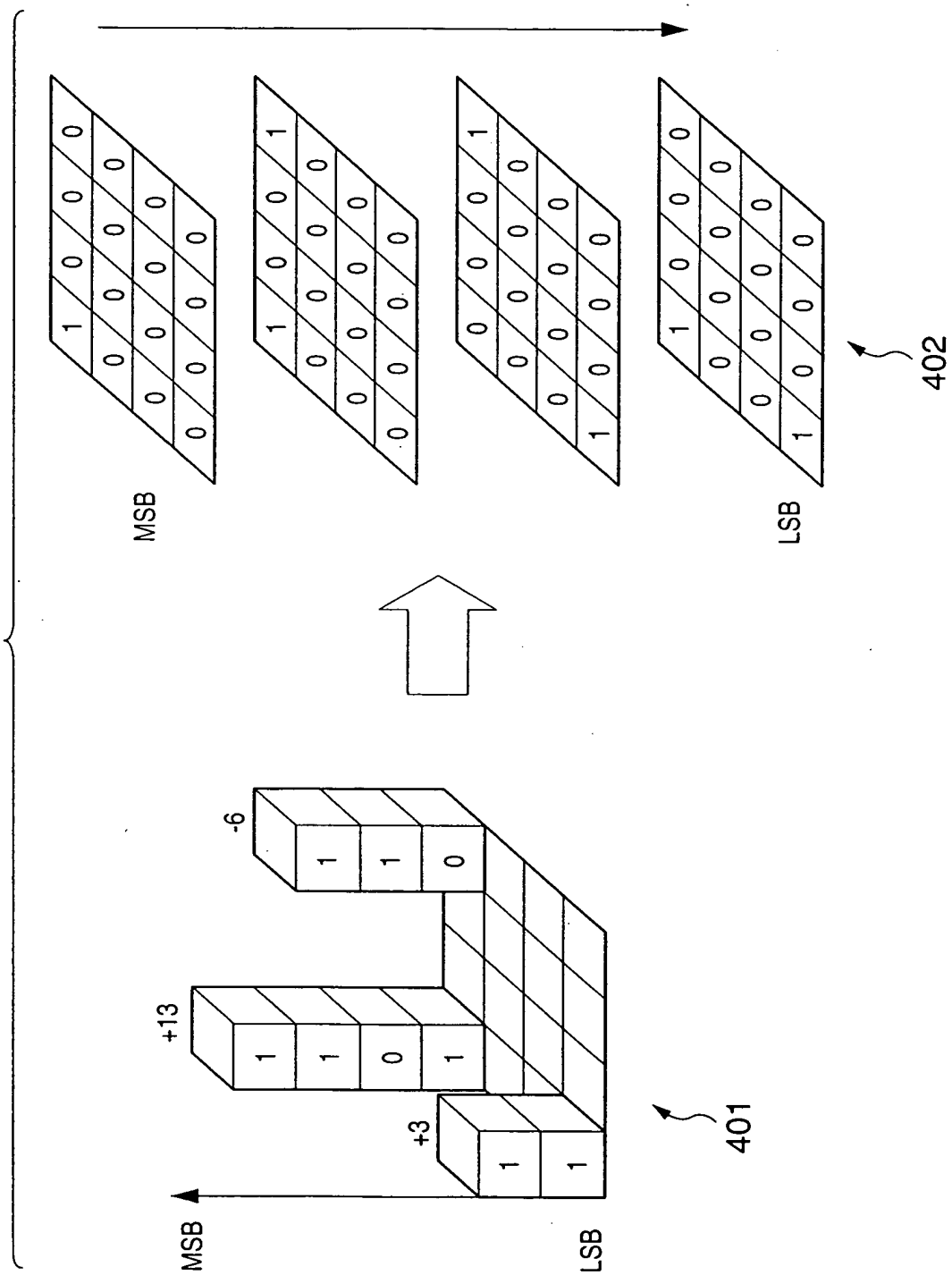

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FIG. 5A

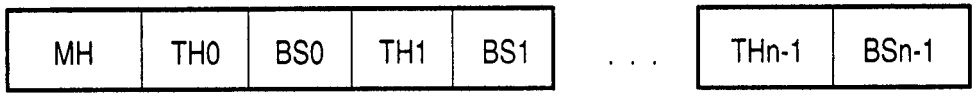

FIG. 5B

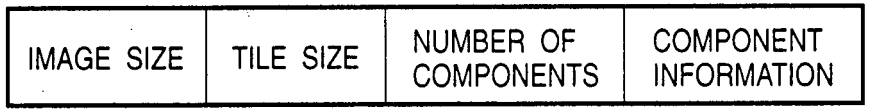

FIG. 5C

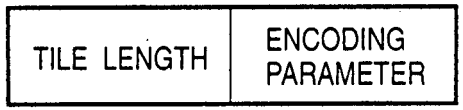

FIG. 5D

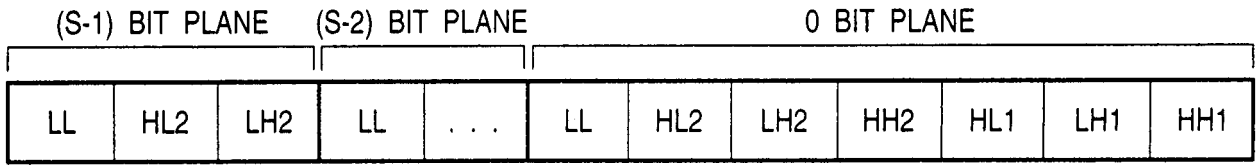

FIG. 6

PATIENT'S NAME	IMAGE SENSING DATA	X-RAY DOSAGE	CODE SEQUENCE

EP 0 470 861 A2

FIG. 7

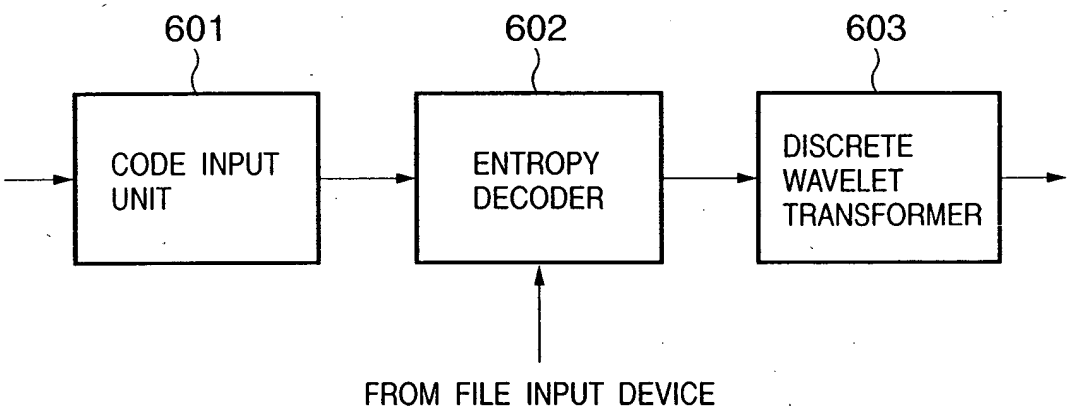
601
602
603
CODE INPUT UNIT
ENTROPY DECODER
DISCRETE WAVELET TRANSFORMER
FROM FILE INPUT DEVICE

FIG. 8

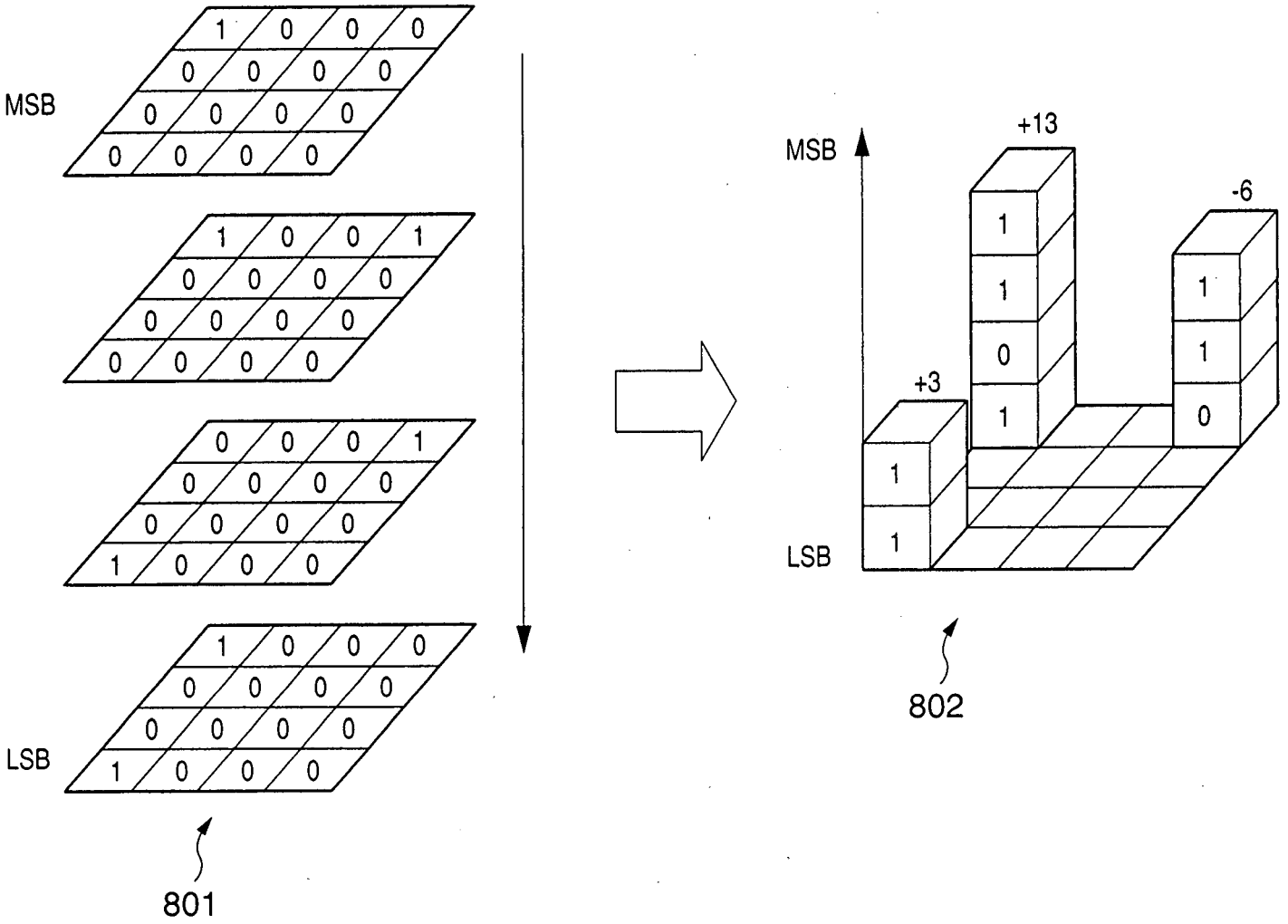

FIG. 9A

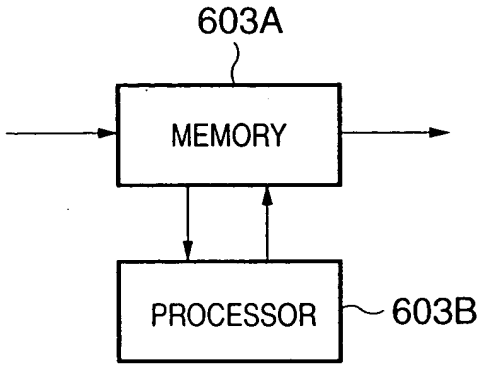

FIG. 9B

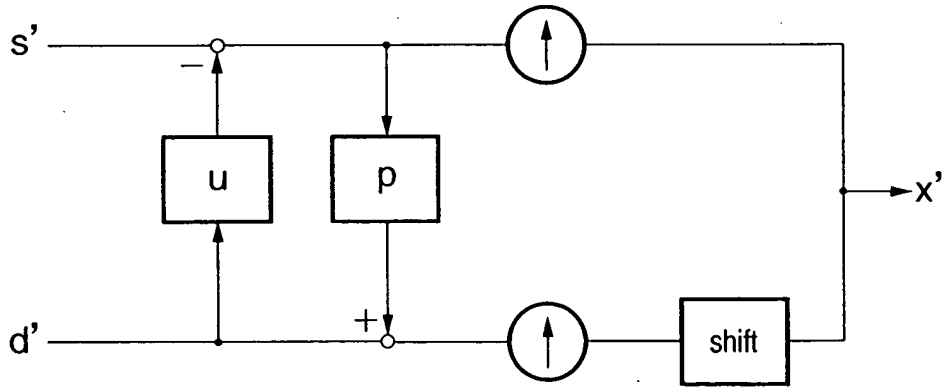

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FIG. 10

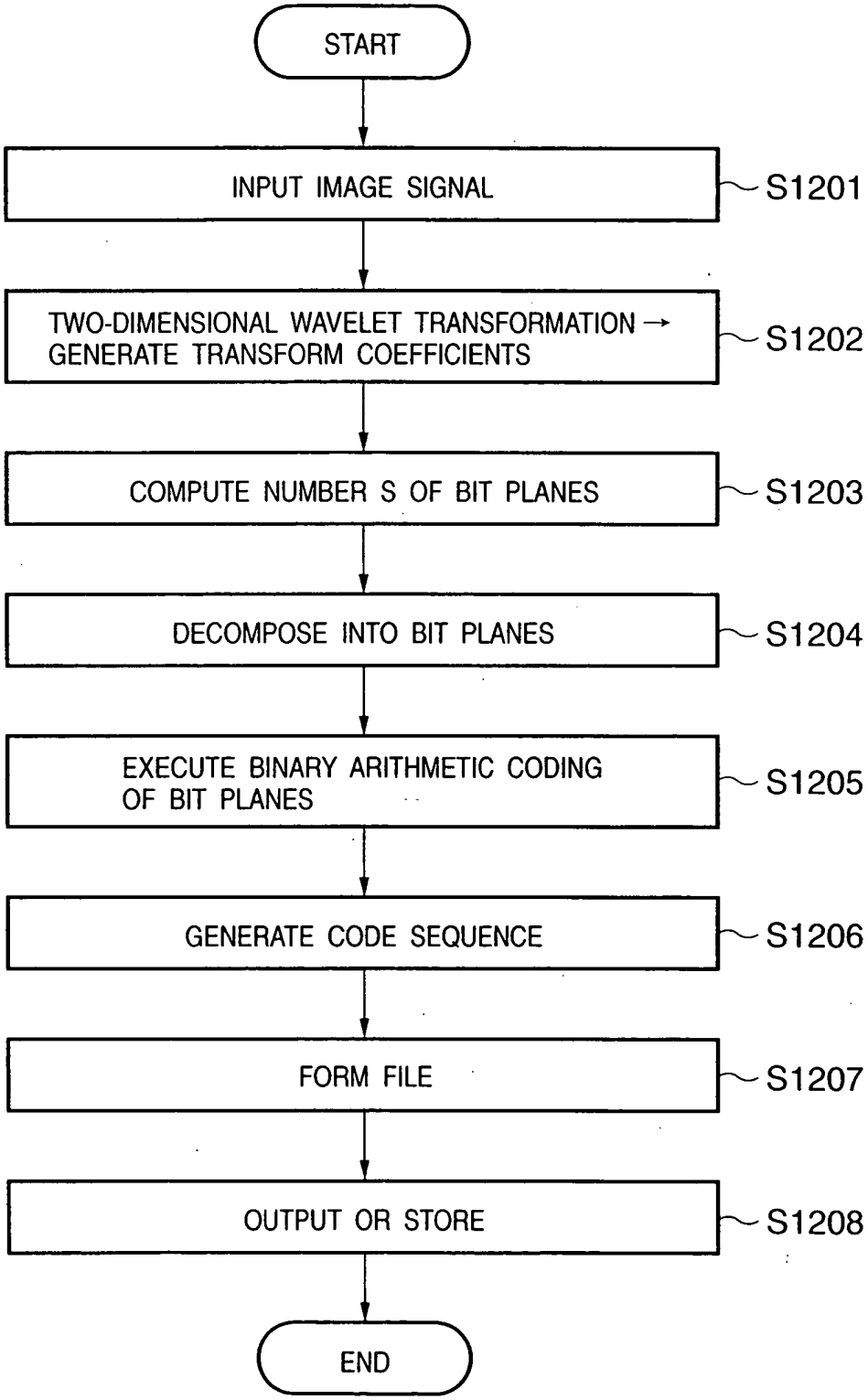
START
INPUT IMAGE SIGNAL
S1201
TWO-DIMENSIONAL WAVELET TRANSFORMATION → GENERATE TRANSFORM COEFFICIENTS
S1202
COMPUTE NUMBER S OF BIT PLANES
S1203
DECOMPOSE INTO BIT PLANES
S1204
EXECUTE BINARY ARITHMETIC CODING OF BIT PLANES
S1205
GENERATE CODE SEQUENCE
S1206
FORM FILE
S1207
OUTPUT OR STORE
S1208
END

FIG. 11

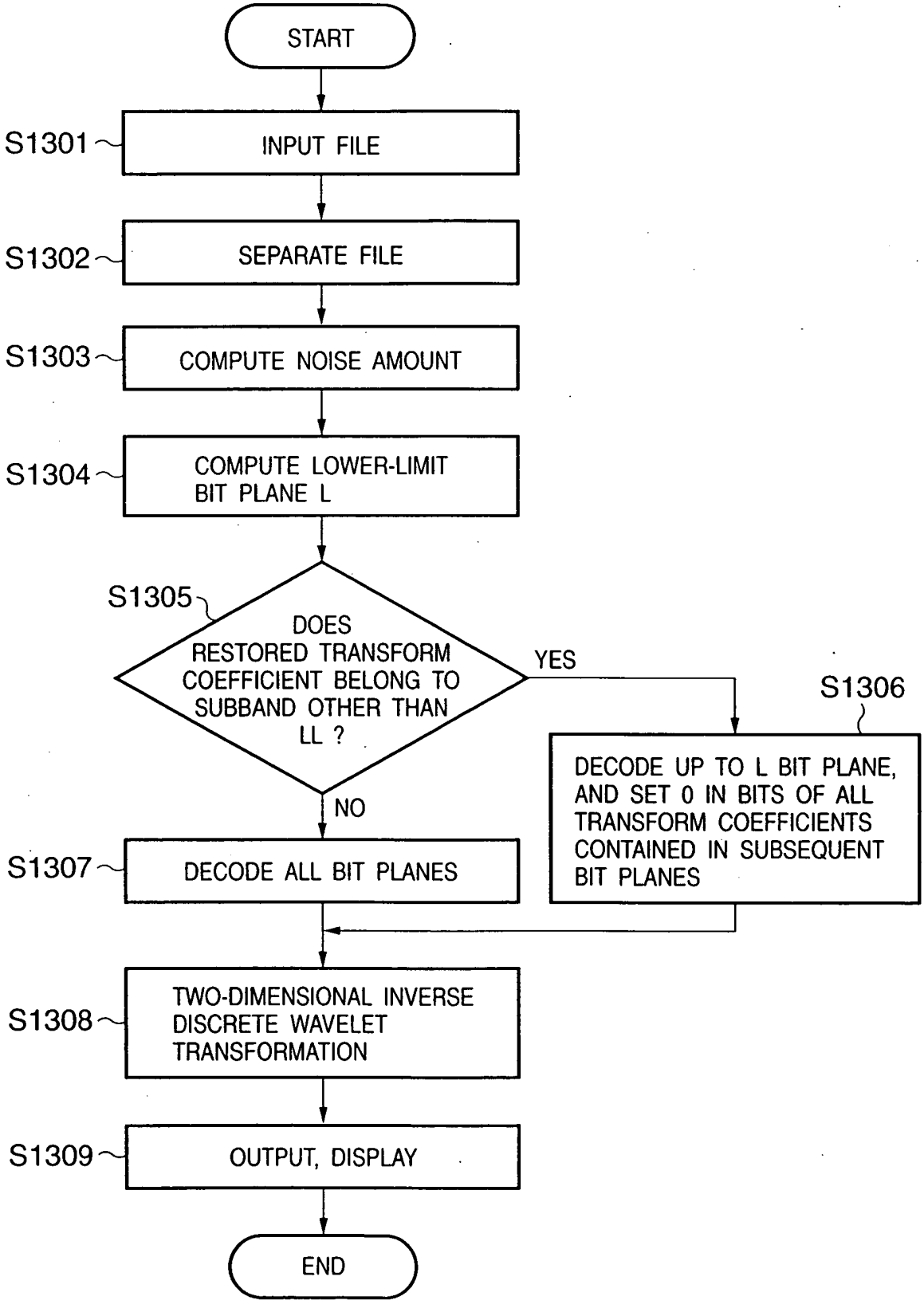
START
S1301
INPUT FILE
S1302
SEPARATE FILE
S1303
COMPUTE NOISE AMOUNT
S1304
COMPUTE LOWER-LIMIT BIT PLANE L
S1305
DOES RESTORED TRANSFORM COEFFICIENT BELONG TO SUBBAND OTHER THAN LL ?
YES
NO
S1306
DECODE UP TO L BIT PLANE, AND SET 0 IN BITS OF ALL TRANSFORM COEFFICIENTS CONTAINED IN SUBSEQUENT BIT PLANES
S1307
DECODE ALL BIT PLANES
S1308
TWO-DIMENSIONAL INVERSE DISCRETE WAVELET TRANSFORMATION
S1309
OUTPUT, DISPLAY
END

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FIG. 12

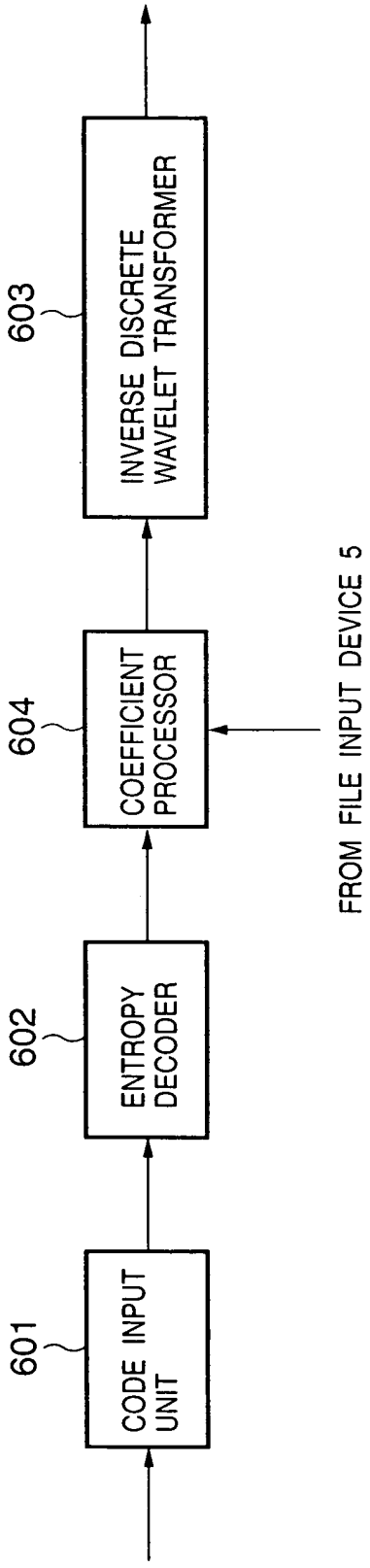

FIG. 13

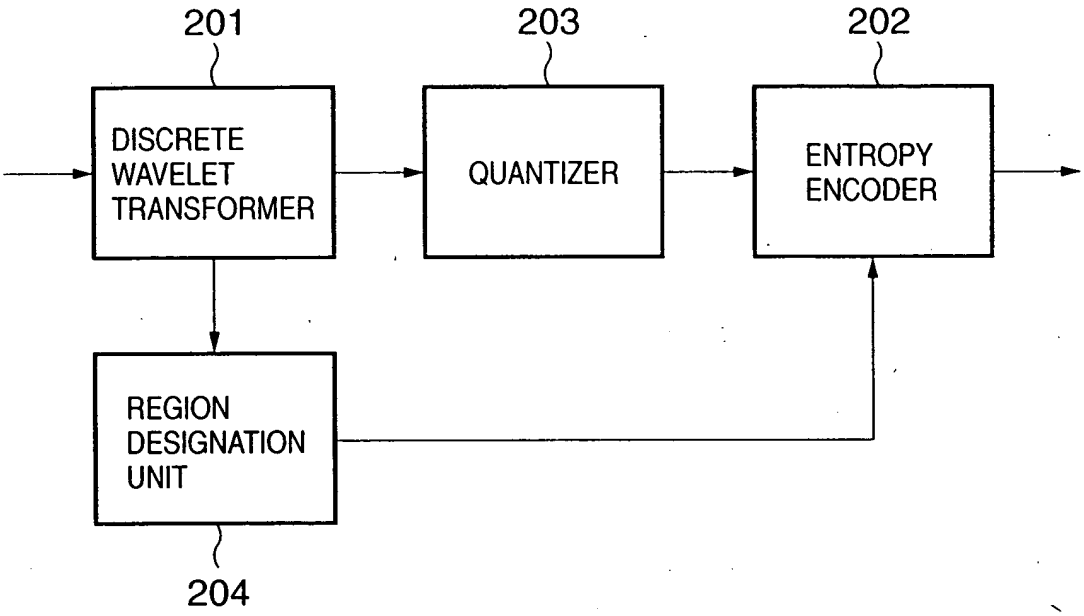
201
203
202
DISCRETE WAVELET TRANSFORMER
QUANTIZER
ENTROPY ENCODER
REGION DESIGNATION UNIT
204

FIG. 14A

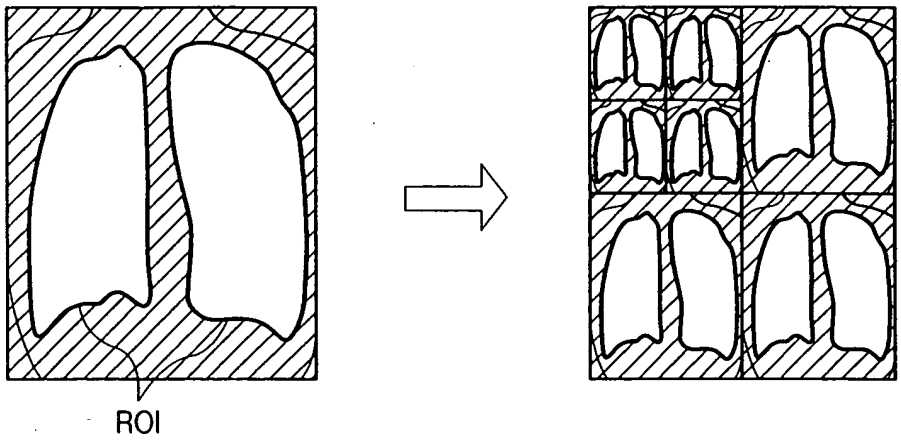

FIG. 14B

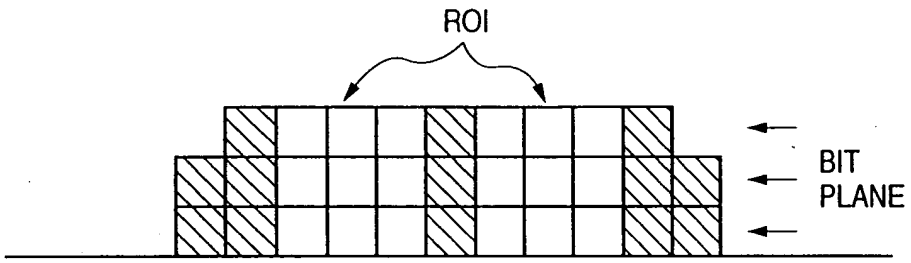

FIG. 14C

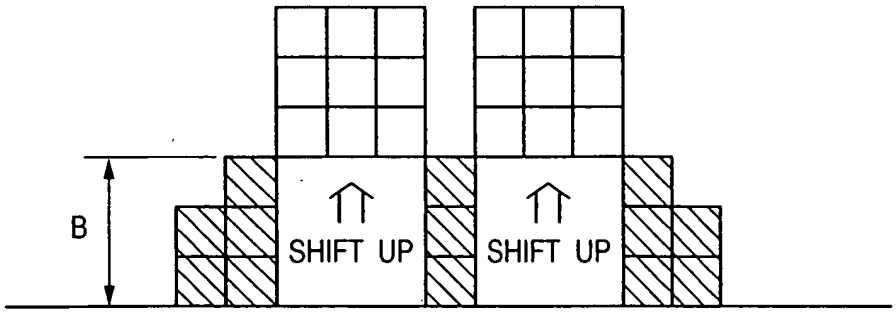

FIG. 15A

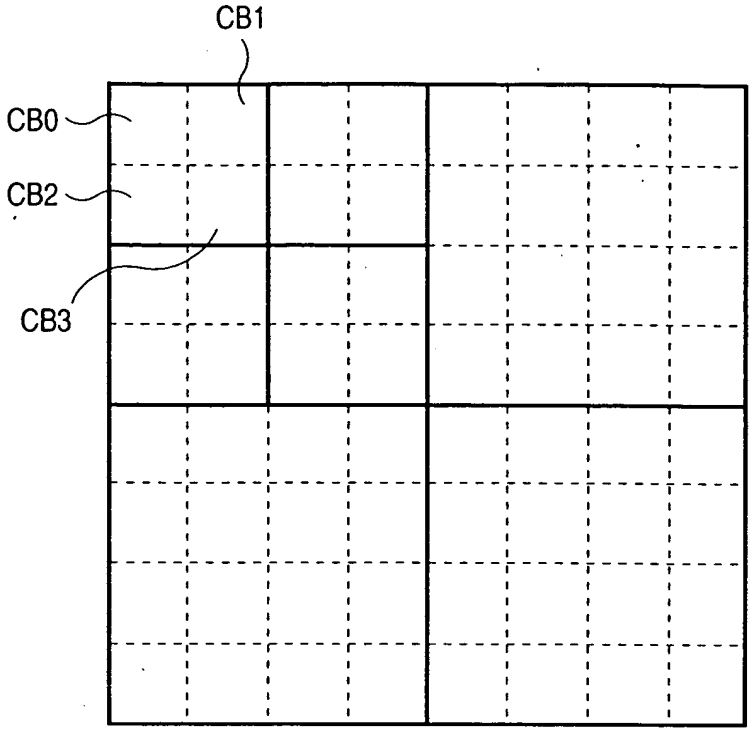

FIG. 15B

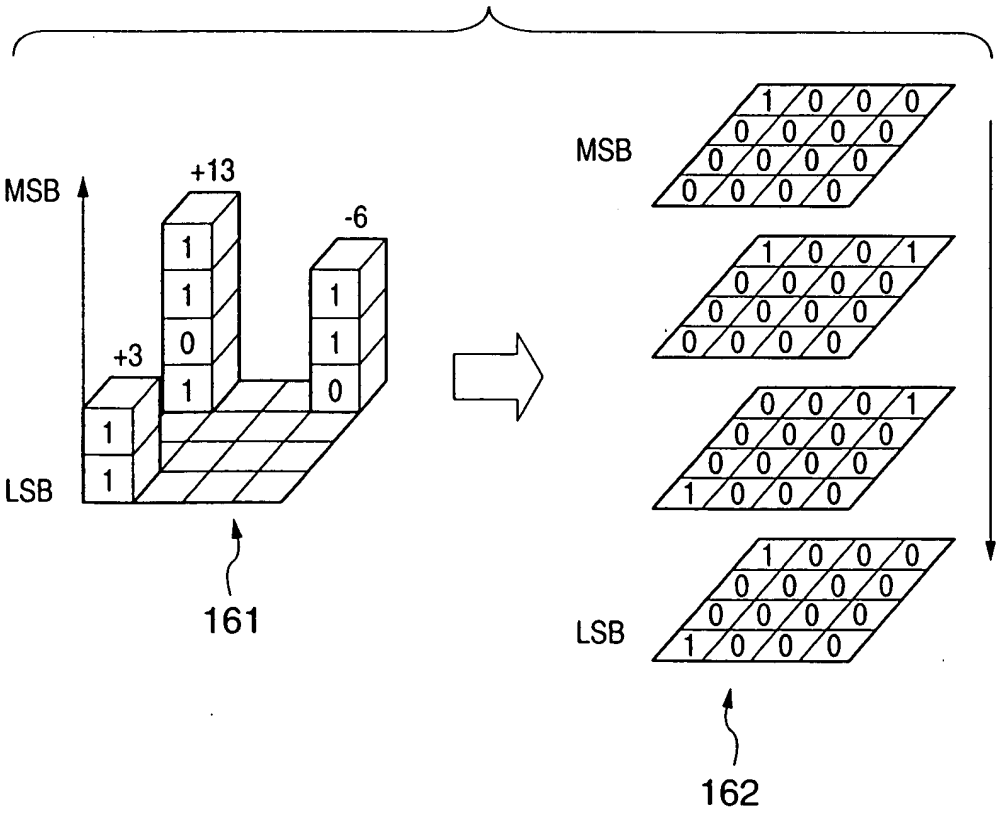

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FIG. 16A

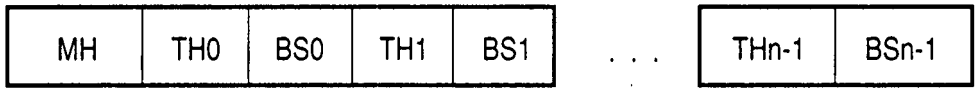

FIG. 16B

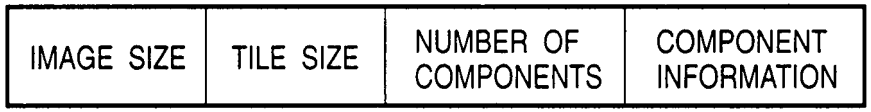

FIG. 16C

FIG. 16D

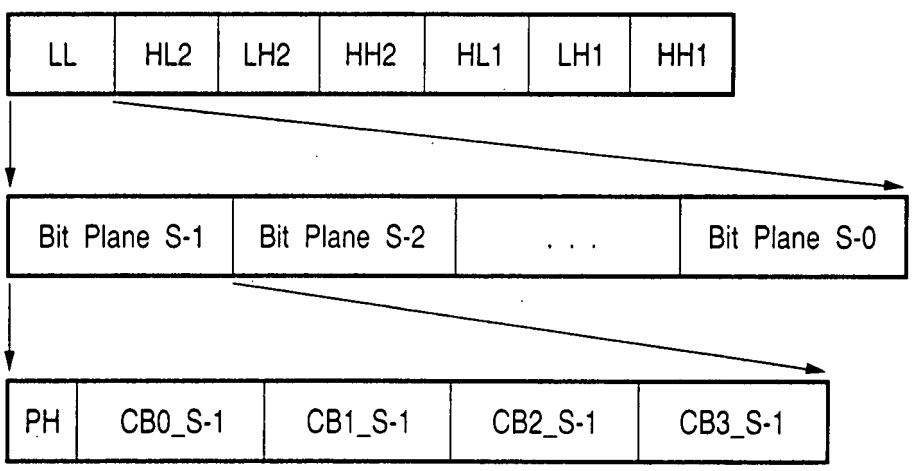

FIG. 17

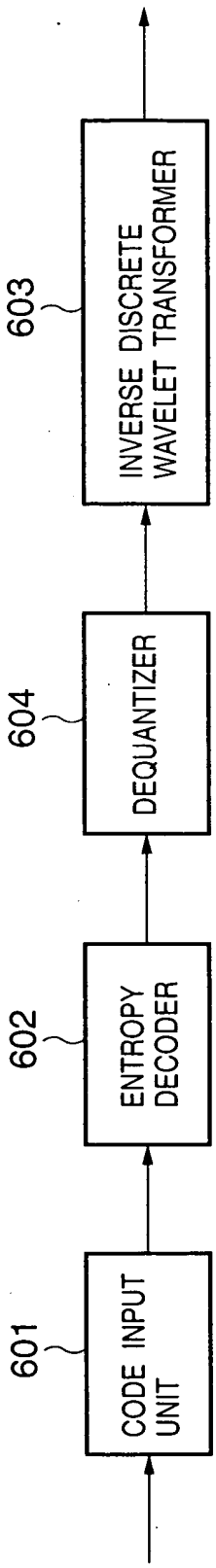
601
CODE INPUT UNIT
602
ENTROPY DECODER
604
DEQUANTIZER
603
INVERSE DISCRETE WAVELET TRANSFORMER

FIG. 18

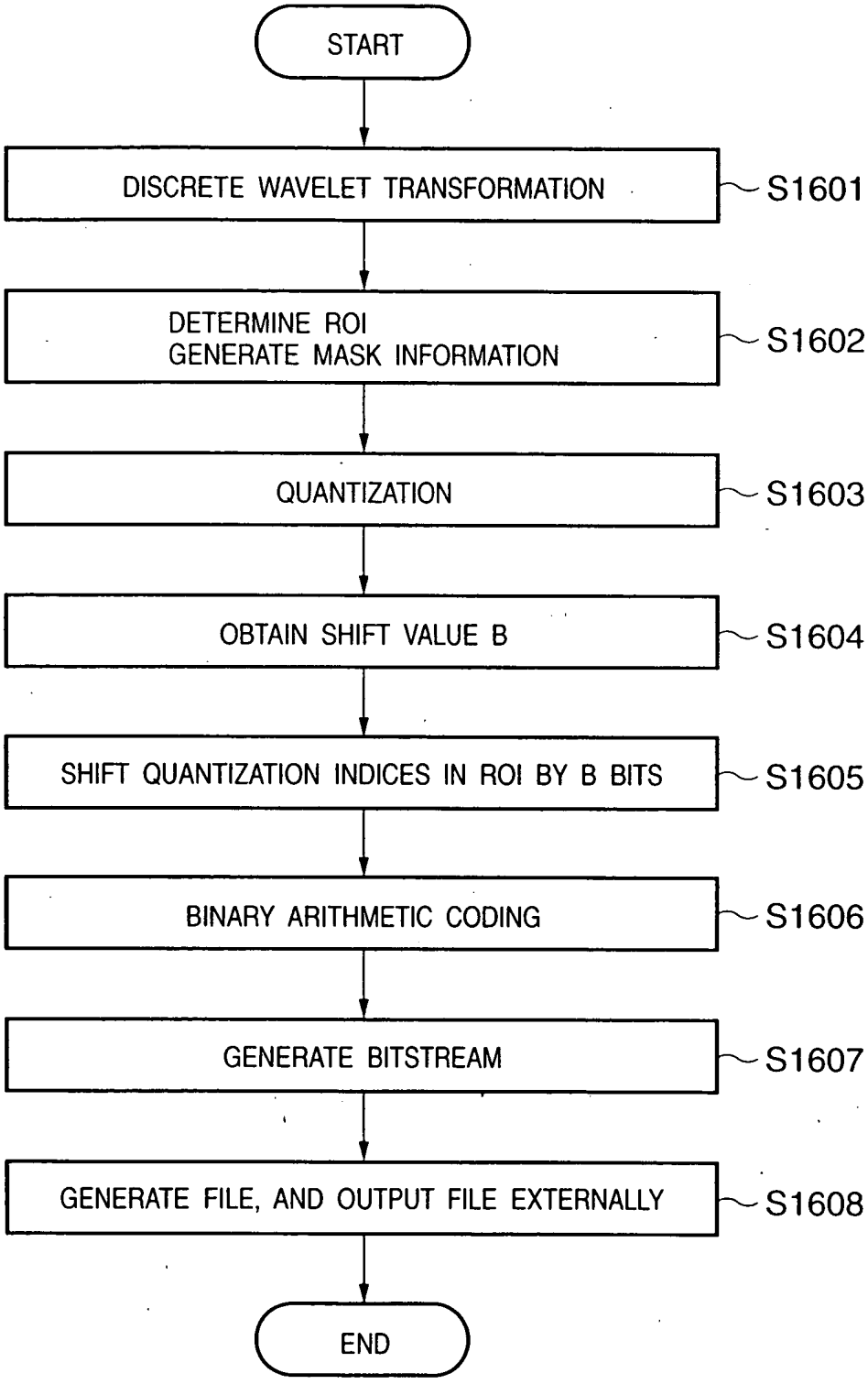
START
DISCRETE WAVELET TRANSFORMATION
S1601
DETERMINE ROI
GENERATE MASK INFORMATION
S1602
QUANTIZATION
S1603
OBTAIN SHIFT VALUE B
S1604
SHIFT QUANTIZATION INDICES IN ROI BY B BITS
S1605
BINARY ARITHMETIC CODING
S1606
GENERATE BITSTREAM
S1607
GENERATE FILE, AND OUTPUT FILE EXTERNALLY
S1608
END

FIG. 19

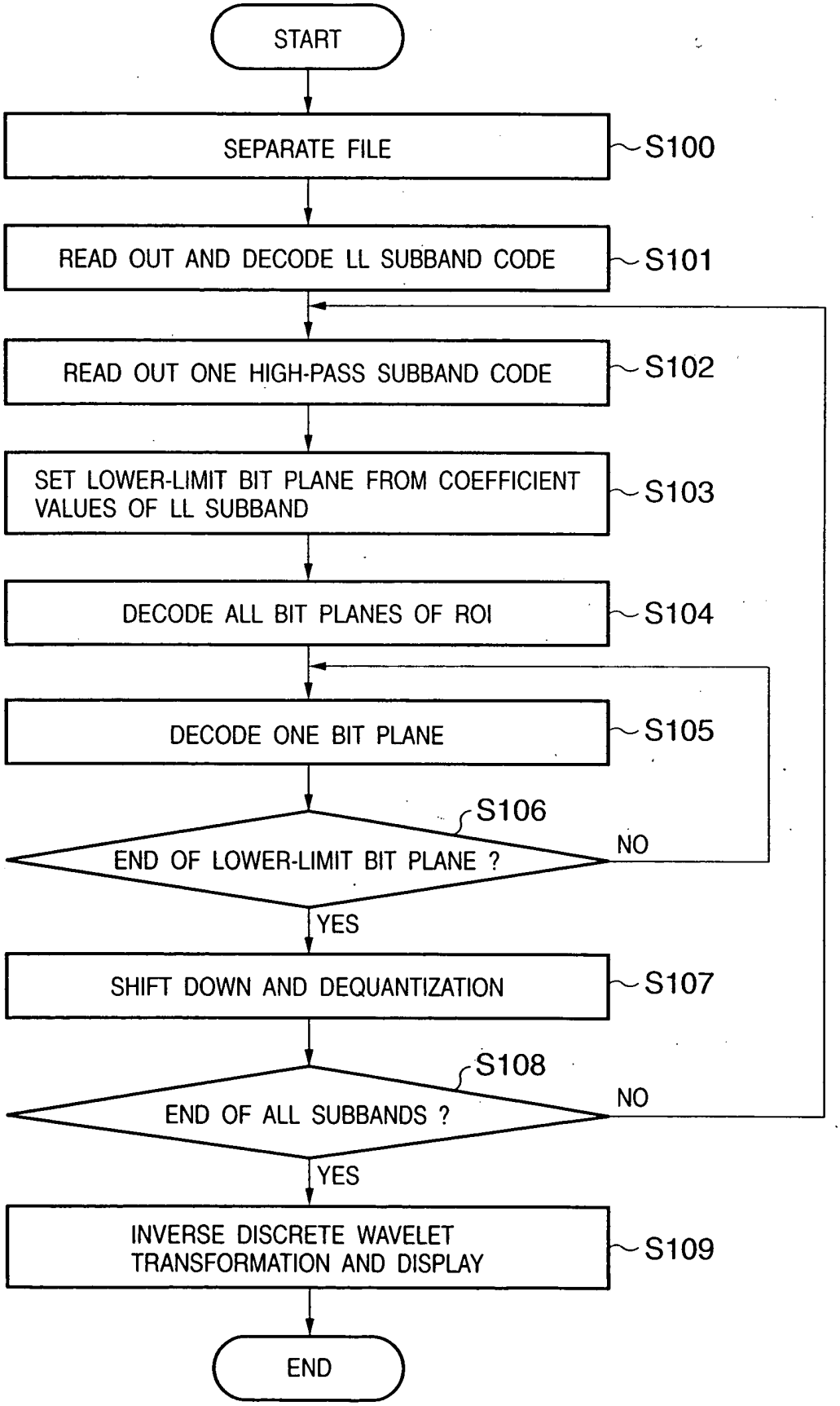
START
SEPARATE FILE
S100
READ OUT AND DECODE LL SUBBAND CODE
S101
READ OUT ONE HIGH-PASS SUBBAND CODE
S102
SET LOWER-LIMIT BIT PLANE FROM COEFFICIENT VALUES OF LL SUBBAND
S103
DECODE ALL BIT PLANES OF ROI
S104
DECODE ONE BIT PLANE
S105
S106
END OF LOWER-LIMIT BIT PLANE ?
NO
YES
SHIFT DOWN AND DEQUANTIZATION
S107
S108
END OF ALL SUBBANDS ?
NO
YES
INVERSE DISCRETE WAVELET TRANSFORMATION AND DISPLAY
S109
END

FIG. 20A

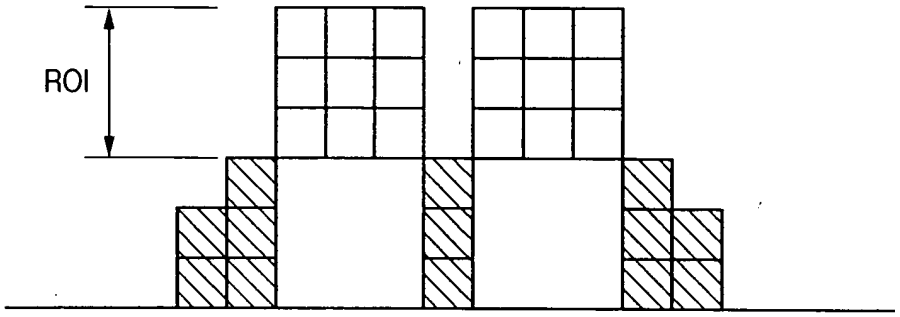

FIG. 20B

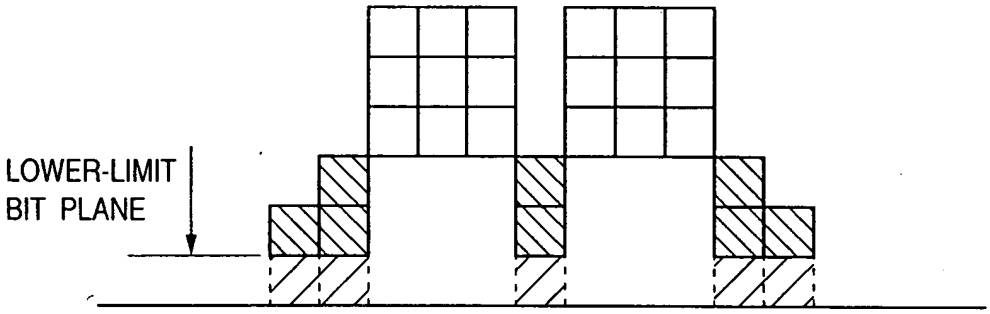

FIG. 20C

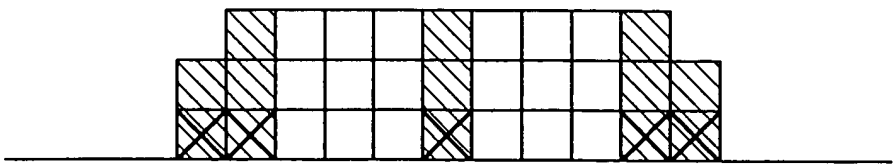

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FIG. 21

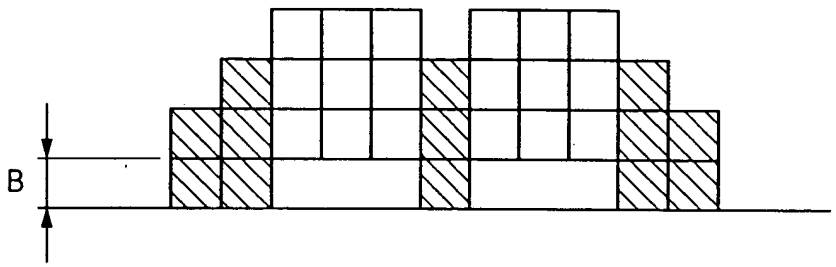

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FIG. 22

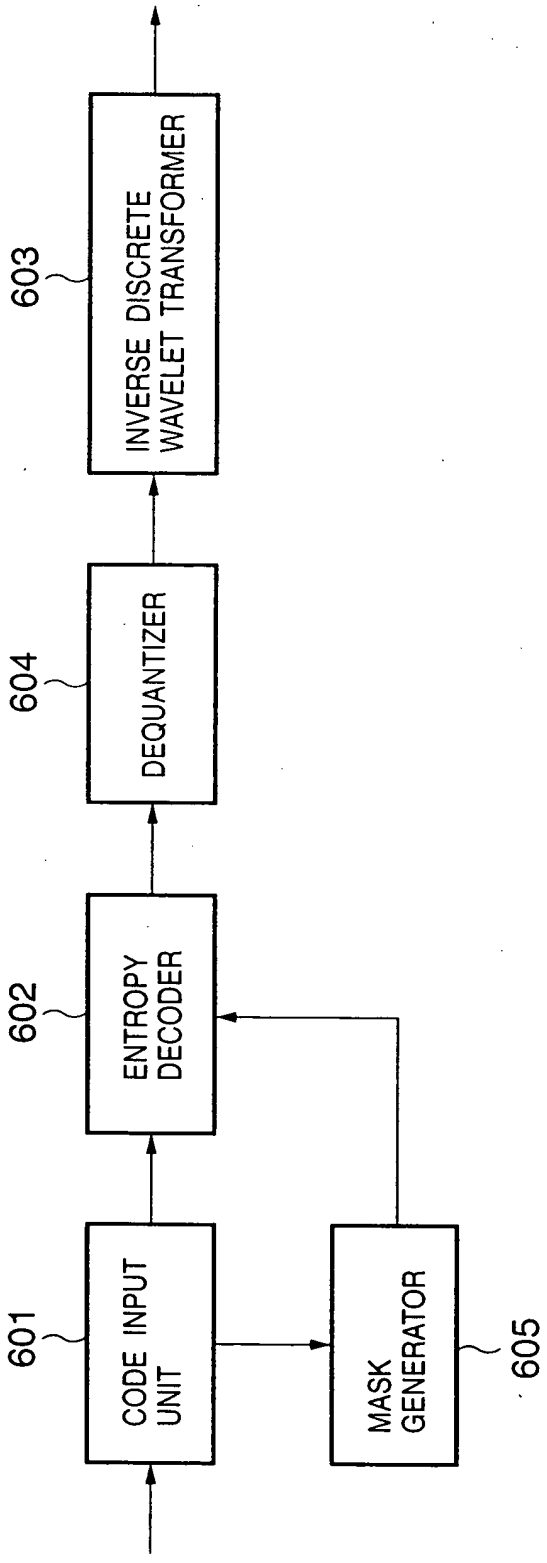

601
CODE INPUT UNIT
602
ENTROPY DECODER
604
DEQUANTIZER
603
INVERSE DISCRETE WAVELET TRANSFORMER
605
MASK GENERATOR

FIG. 23

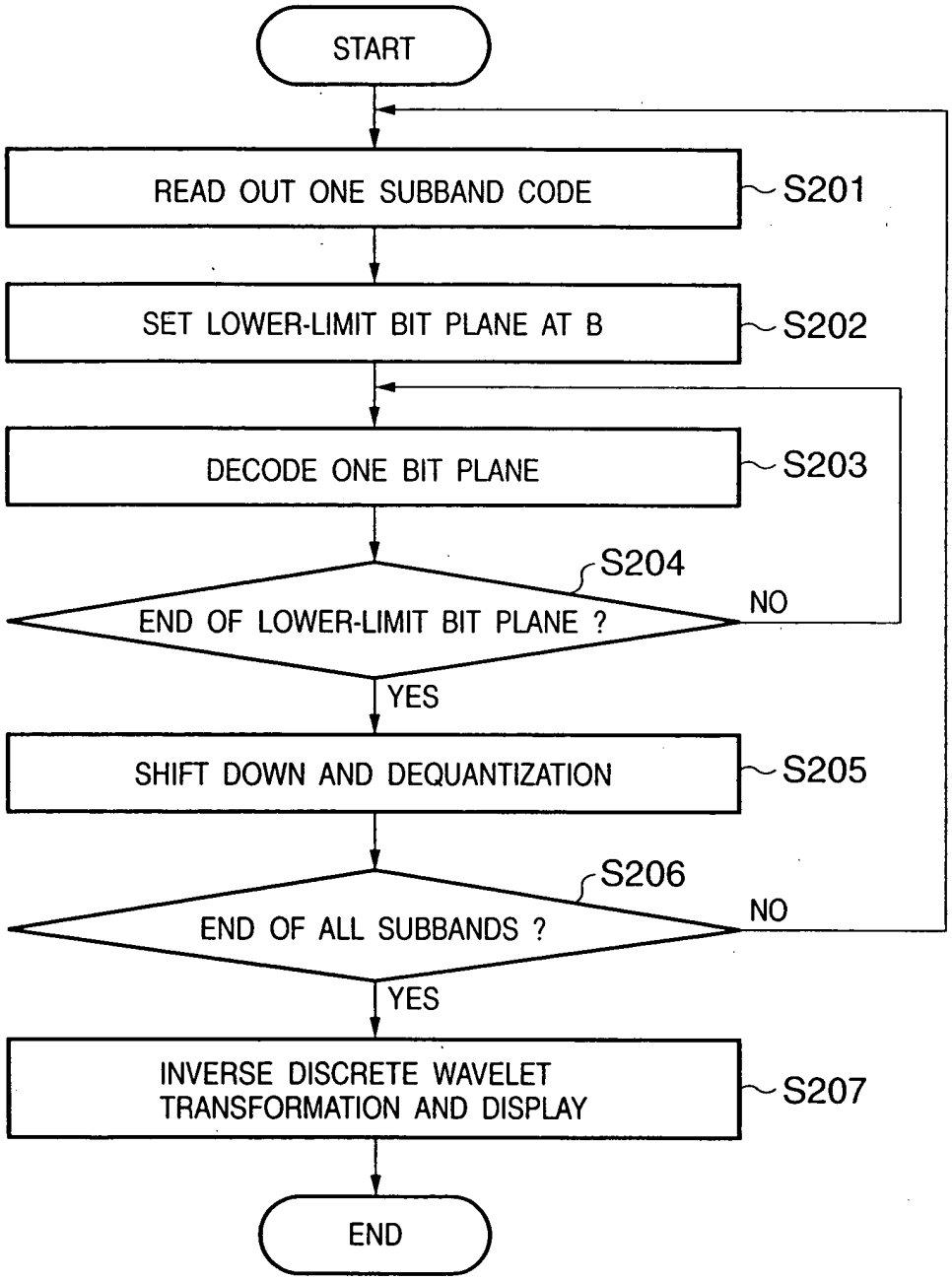

START
READ OUT ONE SUBBAND CODE
S201
SET LOWER-LIMIT BIT PLANE AT B
S202
DECODE ONE BIT PLANE
S203
S204
END OF LOWER-LIMIT BIT PLANE ?
NO
YES
SHIFT DOWN AND DEQUANTIZATION
S205
S206
END OF ALL SUBBANDS ?
NO
YES
INVERSE DISCRETE WAVELET TRANSFORMATION AND DISPLAY
S207
END

FIG. 24

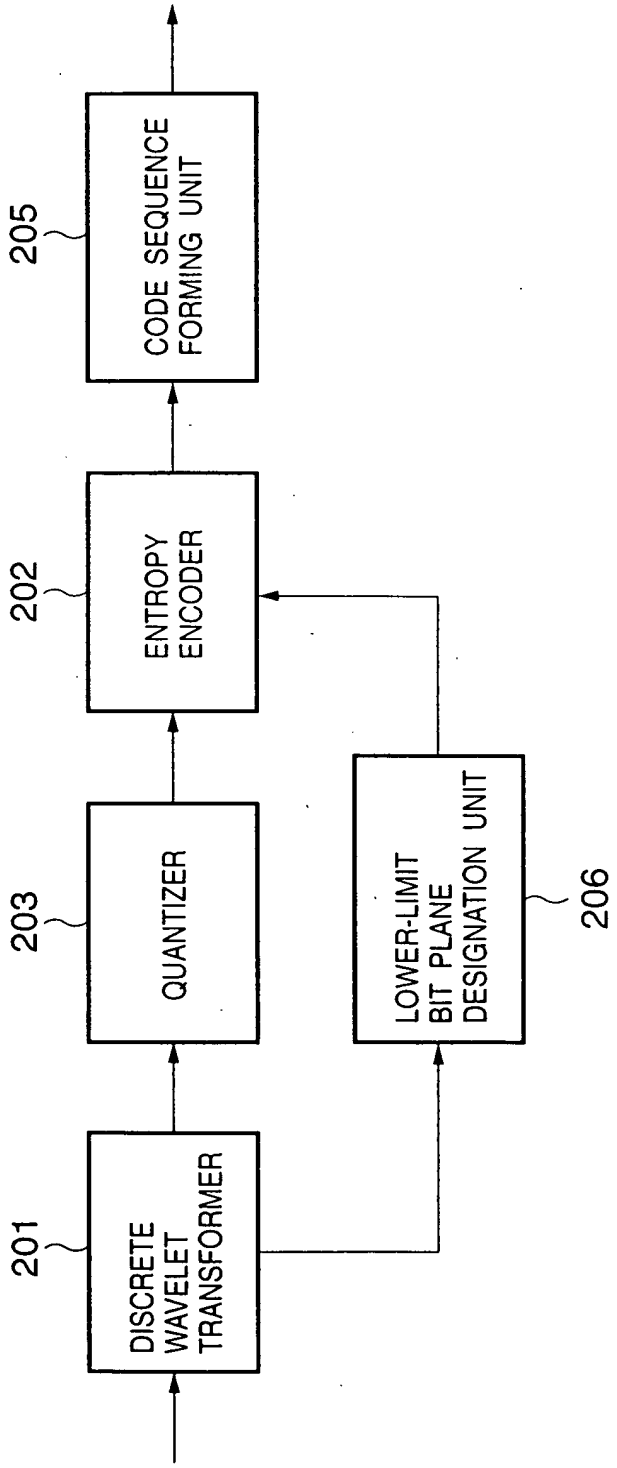
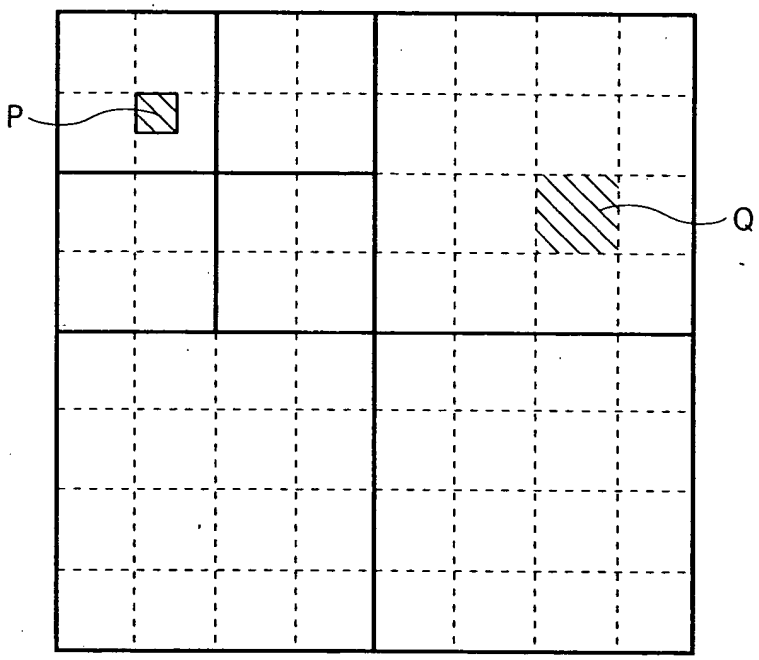

201
DISCRETE WAVELET TRANSFORMER
203
QUANTIZER
202
ENTROPY ENCODER
205
CODE SEQUENCE FORMING UNIT
206
LOWER-LIMIT BIT PLANE DESIGNATION UNIT

FIG. 25



09855305 041701

FIG. 26

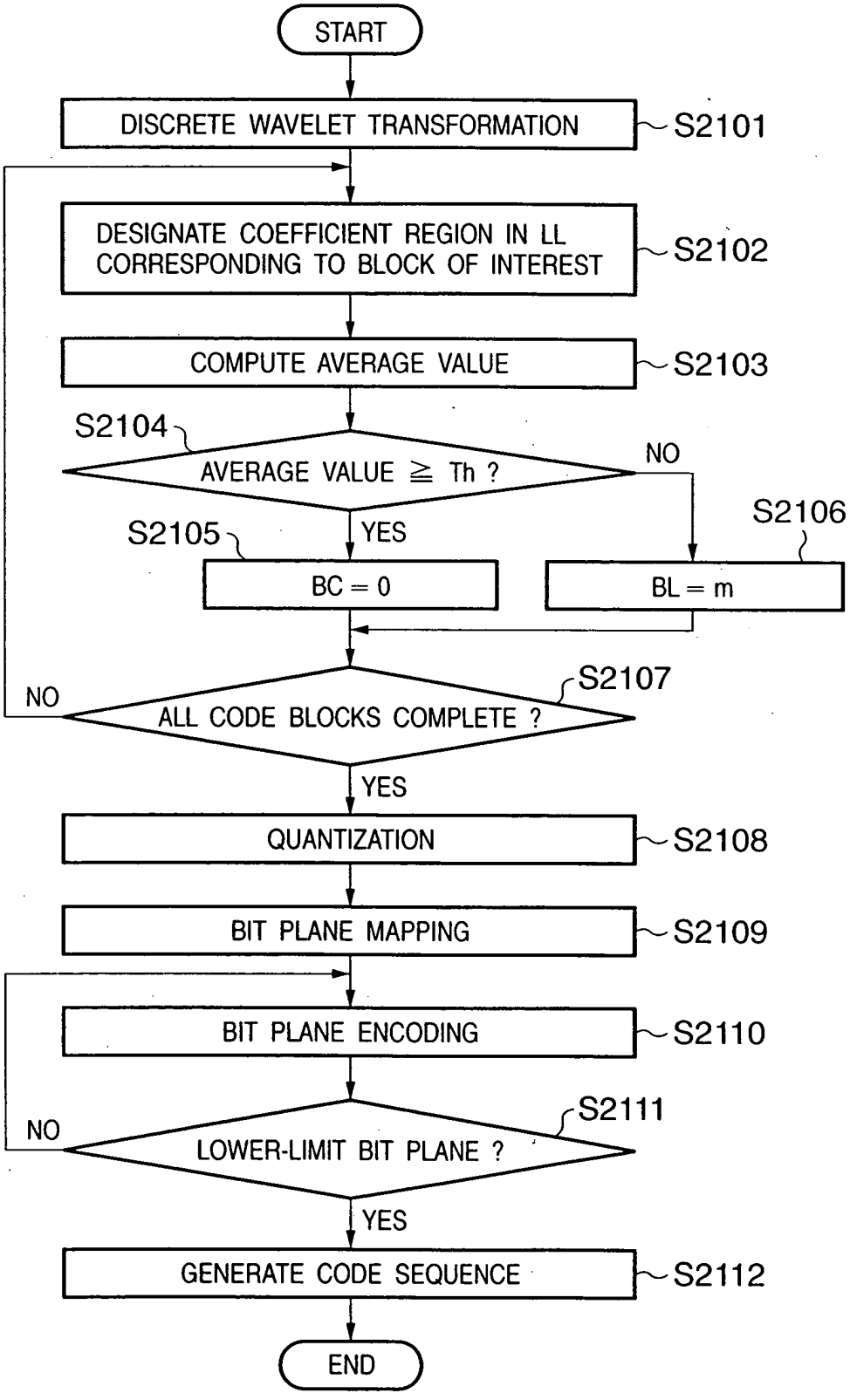

START
DISCRETE WAVELET TRANSFORMATION
S2101
DESIGNATE COEFFICIENT REGION IN LL CORRESPONDING TO BLOCK OF INTEREST
S2102
COMPUTE AVERAGE VALUE
S2103
S2104
AVERAGE VALUE ≧ Th ?
NO
YES
S2105
S2106
BC = 0
BL = m
S2107
NO
ALL CODE BLOCKS COMPLETE ?
YES
QUANTIZATION
S2108
BIT PLANE MAPPING
S2109
BIT PLANE ENCODING
S2110
S2111
NO
LOWER-LIMIT BIT PLANE ?
YES
GENERATE CODE SEQUENCE
S2112
END

FIG. 27

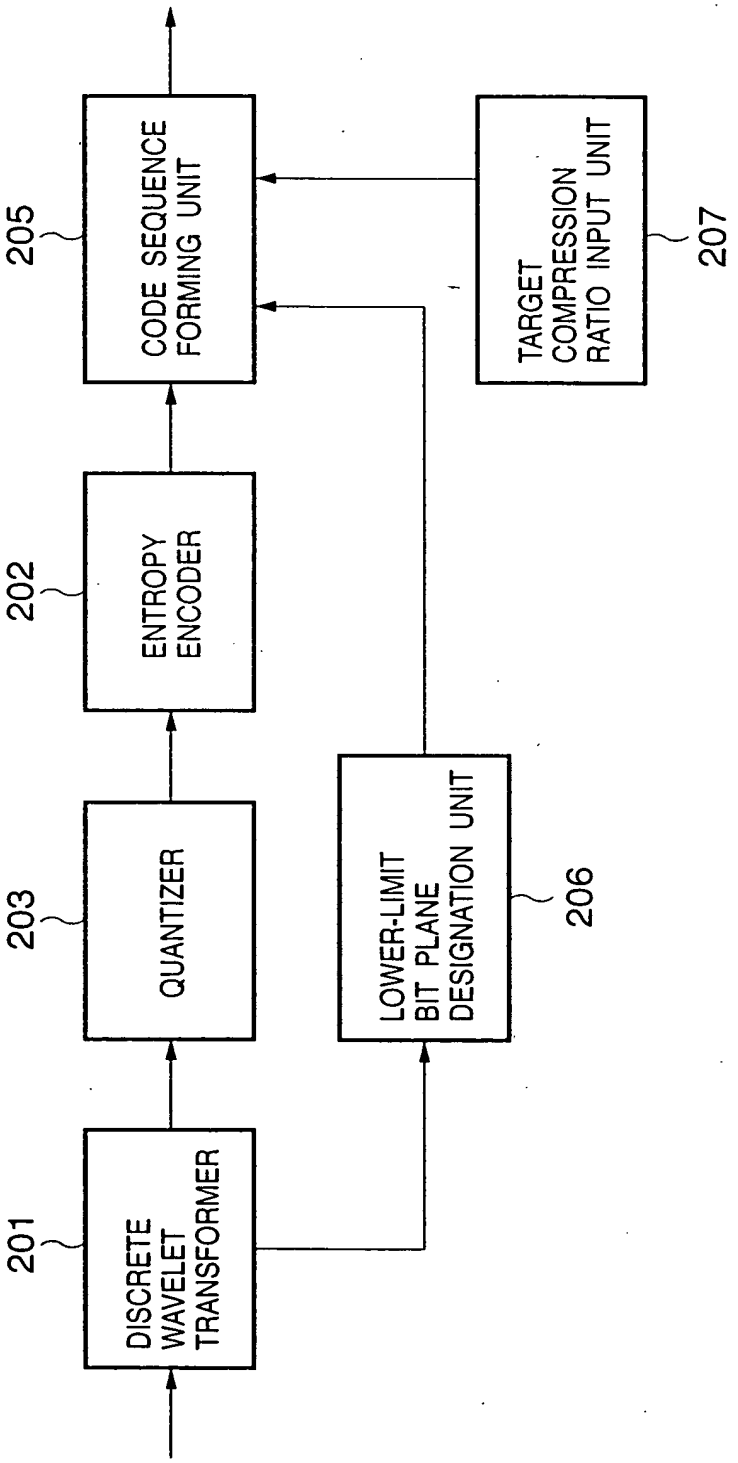

201
DISCRETE WAVELET TRANSFORMER
203
QUANTIZER
202
ENTROPY ENCODER
205
CODE SEQUENCE FORMING UNIT
206
LOWER-LIMIT BIT PLANE DESIGNATION UNIT
207
TARGET COMPRESSION RATIO INPUT UNIT

FIG. 28

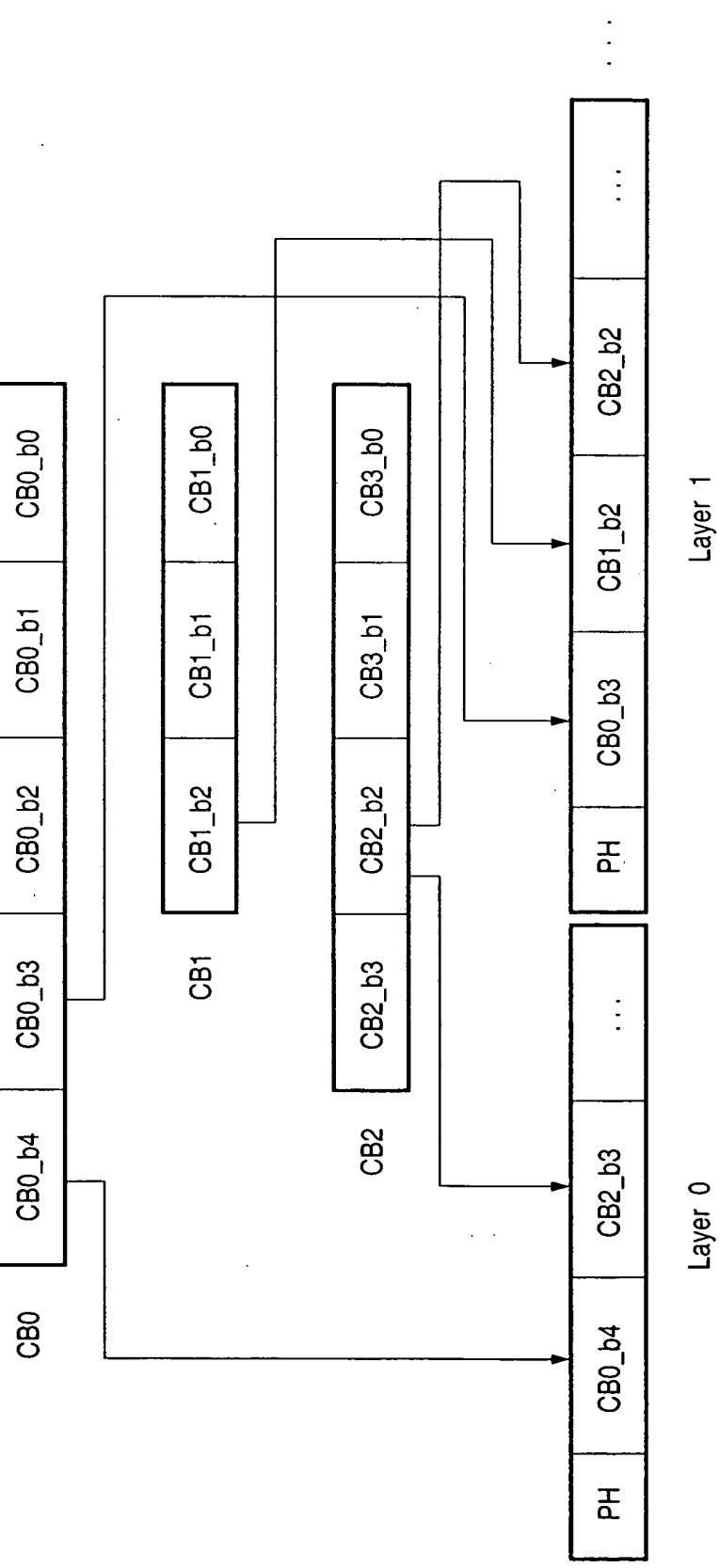

CB0
CB0_b4
CB0_b3
CB0_b2
CB0_b1
CB0_b0
CB1
CB1_b2
CB1_b1
CB1_b0
CB2
CB2_b3
CB2_b2
CB3_b1
CB3_b0
PH
CB0_b4
CB2_b3
...
Layer 0
PH
CB0_b3
CB1_b2
CB2_b2
...
Layer 1

FIG. 29

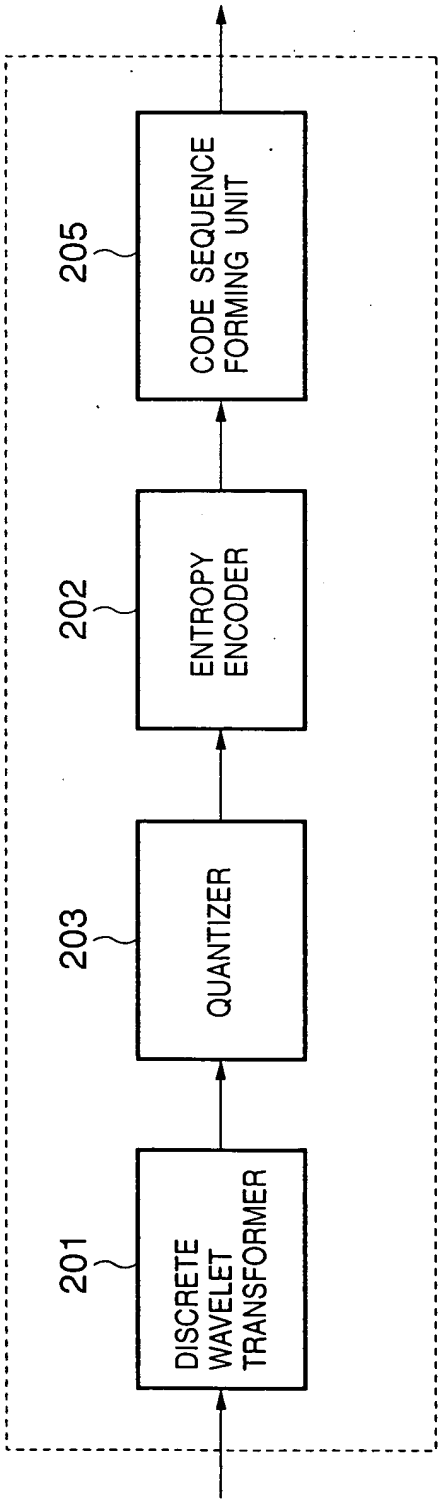

201
DISCRETE WAVELET TRANSFORMER
203
QUANTIZER
202
ENTROPY ENCODER
205
CODE SEQUENCE FORMING UNIT

FIG. 30A

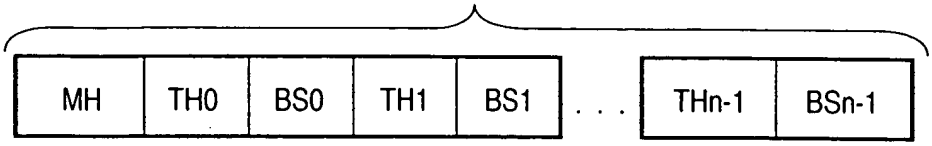


FIG. 30B

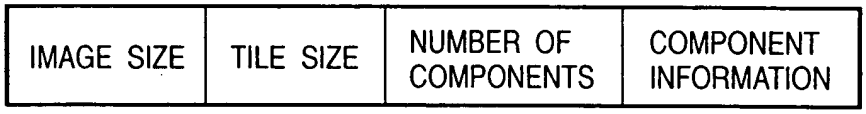


FIG. 30C

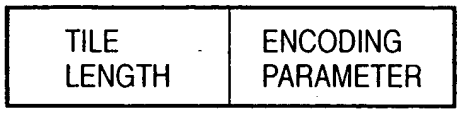


FIG. 30D

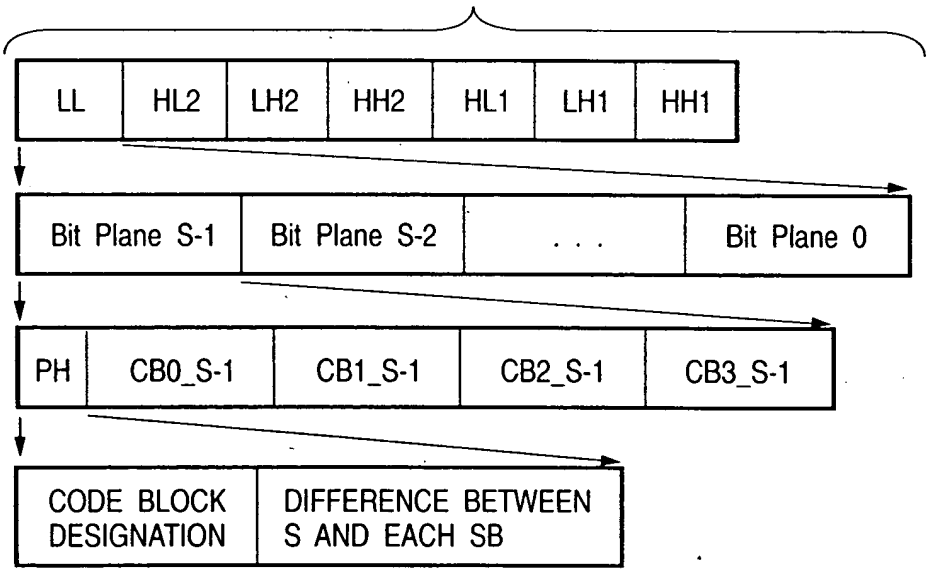


FIG. 30E

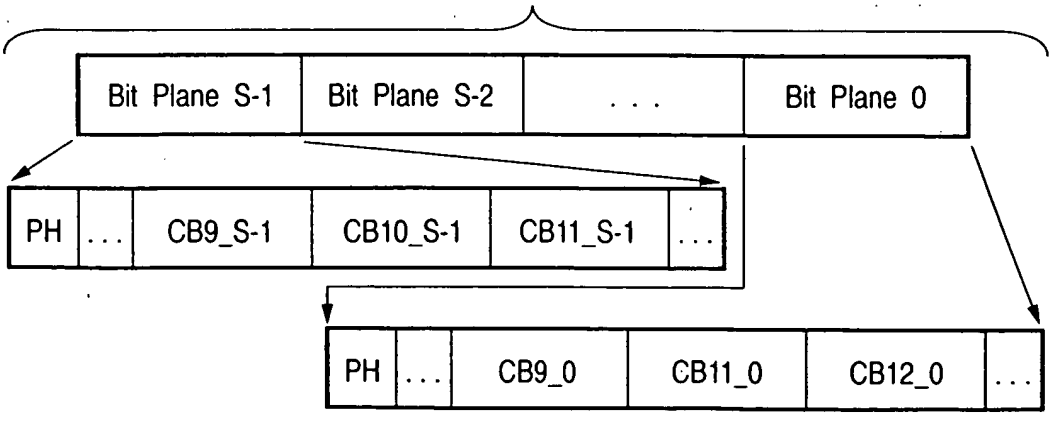


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FIG. 31

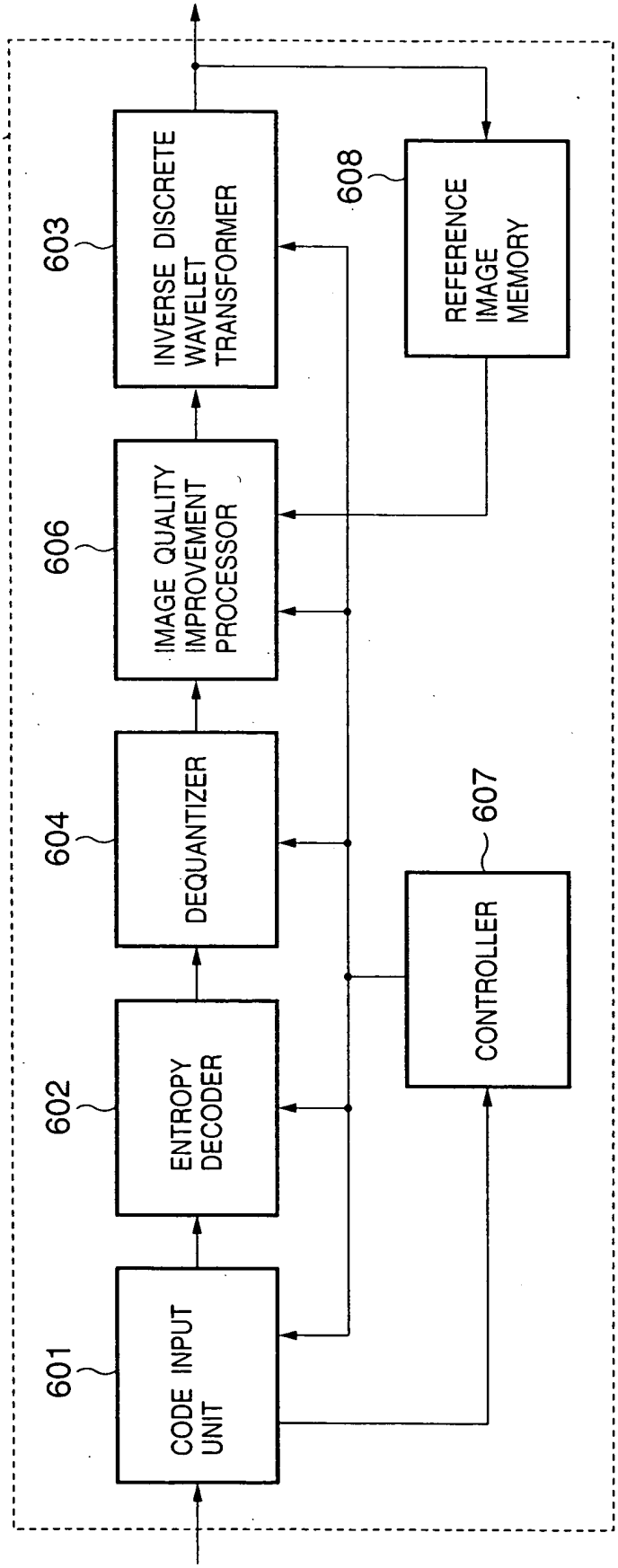
6
601
CODE INPUT UNIT
602
ENTROPY DECODER
604
DEQUANTIZER
606
IMAGE QUALITY IMPROVEMENT PROCESSOR
603
INVERSE DISCRETE WAVELET TRANSFORMER
608
REFERENCE IMAGE MEMORY
607
CONTROLLER

FIG. 32

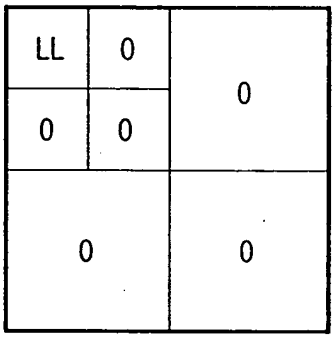

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FIG. 33

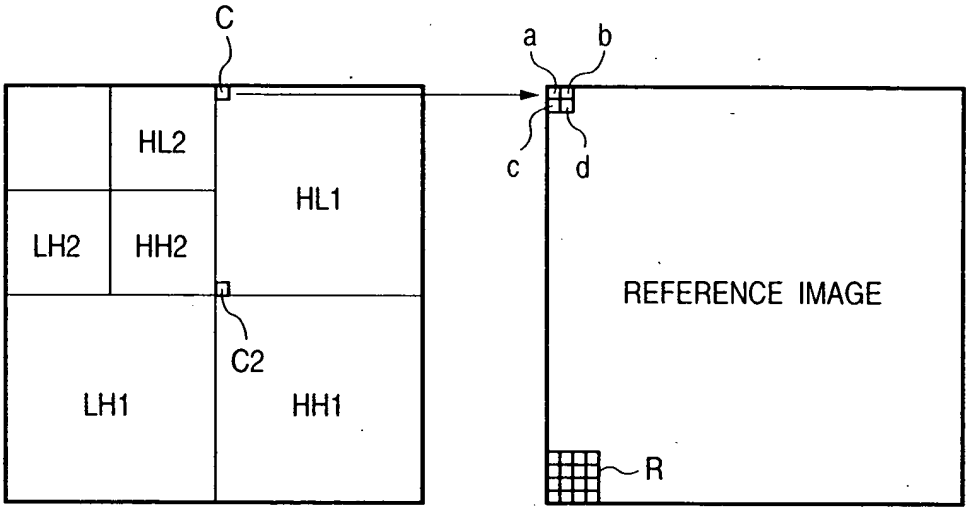

FIG. 34

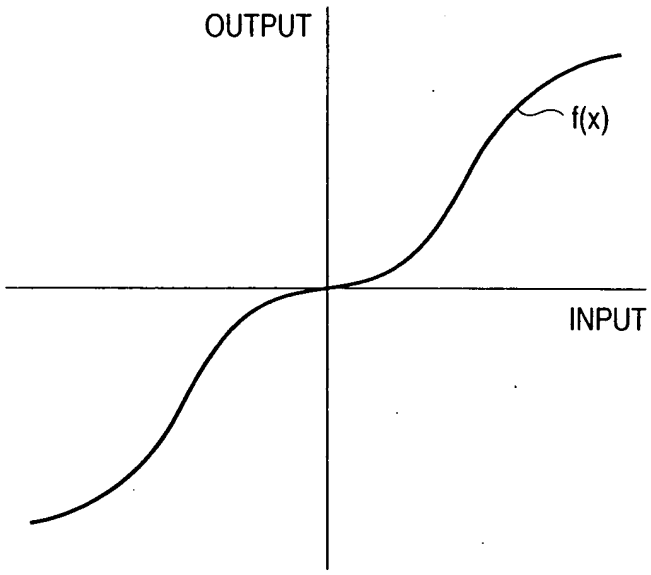

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FIG. 35

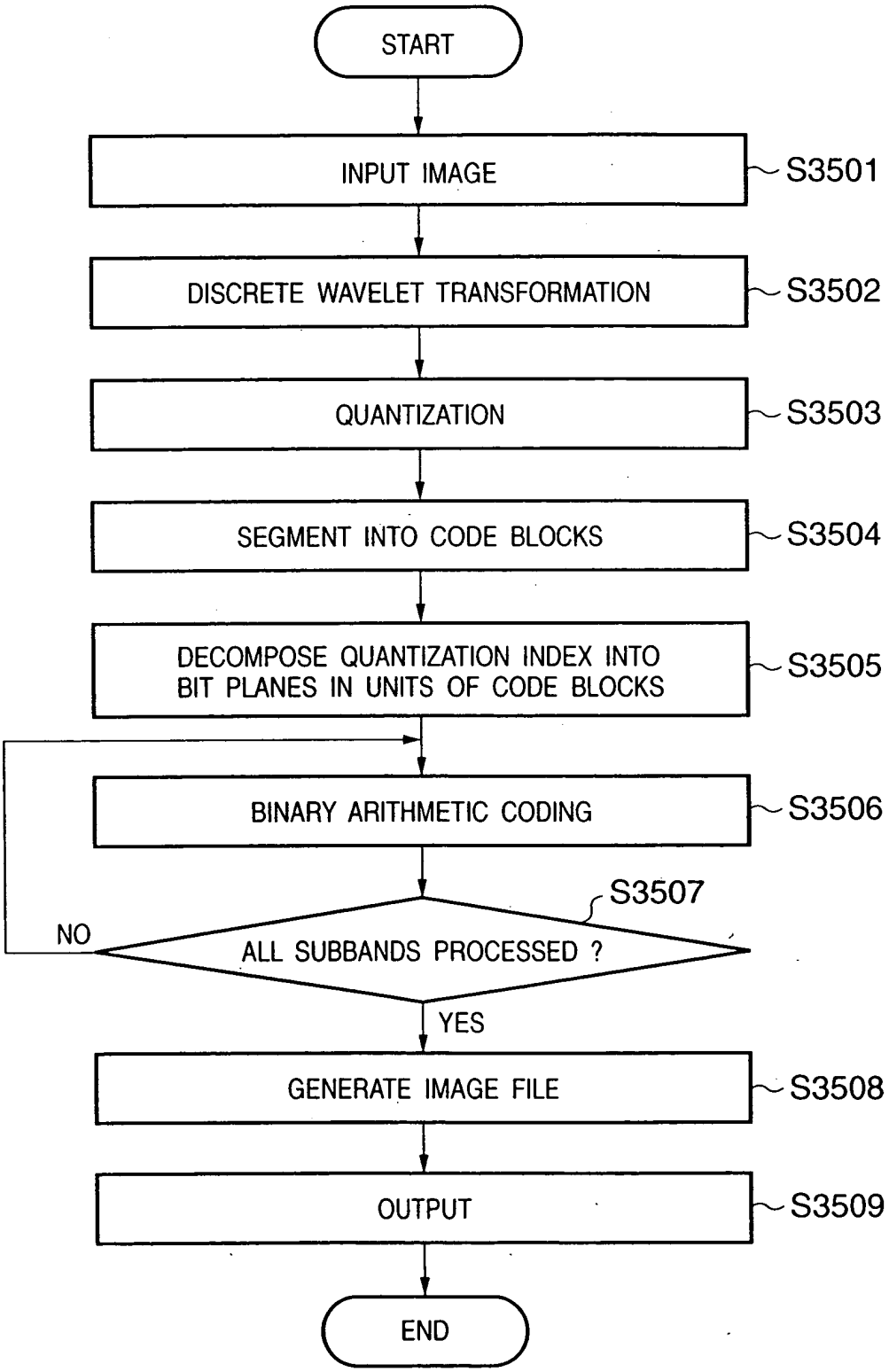

START
INPUT IMAGE
S3501
DISCRETE WAVELET TRANSFORMATION
S3502
QUANTIZATION
S3503
SEGMENT INTO CODE BLOCKS
S3504
DECOMPOSE QUANTIZATION INDEX INTO BIT PLANES IN UNITS OF CODE BLOCKS
S3505
BINARY ARITHMETIC CODING
S3506
S3507
NO
ALL SUBBANDS PROCESSED ?
YES
GENERATE IMAGE FILE
S3508
OUTPUT
S3509
END

FIG. 36

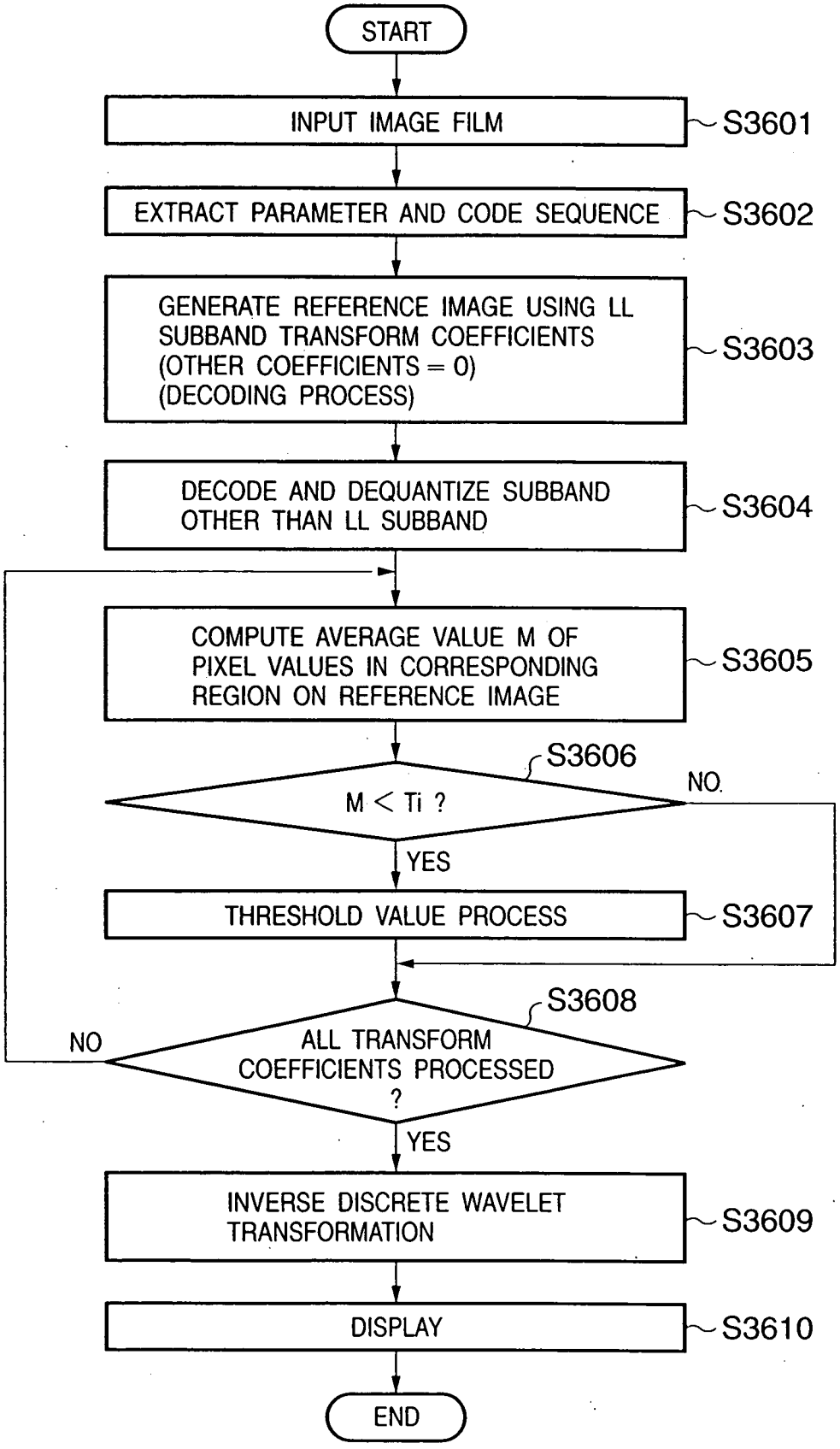
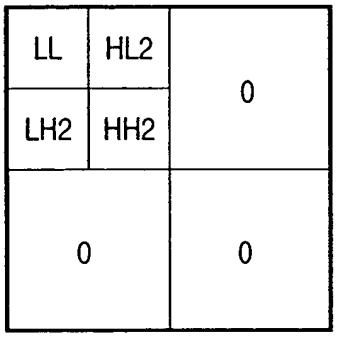

START
INPUT IMAGE FILM
S3601
EXTRACT PARAMETER AND CODE SEQUENCE
S3602
GENERATE REFERENCE IMAGE USING LL SUBBAND TRANSFORM COEFFICIENTS (OTHER COEFFICIENTS = 0) (DECODING PROCESS)
S3603
DECODE AND DEQUANTIZE SUBBAND OTHER THAN LL SUBBAND
S3604
COMPUTE AVERAGE VALUE M OF PIXEL VALUES IN CORRESPONDING REGION ON REFERENCE IMAGE
S3605
S3606
M < Ti ?
NO
YES
THRESHOLD VALUE PROCESS
S3607
S3608
NO
ALL TRANSFORM COEFFICIENTS PROCESSED ?
YES
INVERSE DISCRETE WAVELET TRANSFORMATION
S3609
DISPLAY
S3610
END

FIG. 37



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